Pre-Mac – Model MWP Water Purifier

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Device Information

The Pre-Mac model MWP water purifier is a portable hand-pump water treatment device. According to the manufacturer, microbiological treatment consists of filtration and disinfection. The device consists of flexible inlet tubing containing a fine mesh screen which provides coarse filtration, outlet tubing, a hand pump, and two replaceable cartridges. One cartridge contains an activated carbon cloth which provides filtration and adsorption, and the other cartridge contains an iodine resin which provides disinfection. When treating cloudy, turbid water, the manufacturer recommends using the 2 µm pre-filter. Operation of the hand pump draws water through the fine mesh screen on the inlet tubing and sends the water first through the activated charcoal cloth cartridge and then through the iodine resin cartridge. The resin is designed to impart an iodine residual (typically 2-4 mg/L) in treated water that provides additional disinfection. The manufacturer directs users to provide a minimum of 3 minutes contact time before drinking. A 5-minute contact time is directed when treating water at temperatures of 5° C or less. The manufacturer also offers an optional field test kit for measuring iodine residual in treated water.

Effectiveness Against Microbial Pathogens

No test data is available for the model MWP water purifier using the U.S. Environmental Protection Agency (USEPA) Guide Standard and Protocol for Testing Microbiological Water Purifiers (reference 1). However, an independent laboratory conducted testing using the USEPA Protocol on an earlier Pre-Mac model water purifier that is very similar in operation and treatment technology (reference 2). Therefore, these results are considered applicable to the model MWP water purifier. The results showed the earlier model consistently met the 6-log and 4-log bacteria and virus removal/inactivation minimum requirements. The device did not consistently meet the minimum 3-log protozoan cyst removal/inactivation requirement when challenged with *Cryptosporidium* oocysts. These test results suggest the Pre-Mac MWP would meet the minimum 6-log bacteria and 4-log virus removal/inactivation requirements when used according to directions. The results also suggest the Pre-Mac MWP would not meet the required minimum 3-log cyst removal/inactivation for *Cryptosporidium* oocysts. Other independent testing using protocols other than the USEPA Protocol verify the ability of the Pre-Mac MWP to provide at least a 6-log bacteria and 4-log virus removal/inactivation. Available testing data did not include *Giardia* cysts as a test organism. Based on general knowledge of the treatment technologies used in the MWP water purifier (activated carbon and iodine resin) and the

intermittent use of the 2 µm pre-filter with high turbidity waters, the MWP water purifier would not consistently provide a 3-log removal or inactivation of *Giardia* cysts when used as directed. If the iodine resin is a pentaiodide (I_5) resin, the device would be capable of reducing *Giardia* cysts if contact time after passage through the device were extended to at least 40 minutes (reference 3). However, since there are no device-specific testing data available using *Giardia* cysts and we do not know the exact composition of the iodine resin, we must consider the device ineffective against *Giardia* cysts. Additional treatment is, therefore, necessary to remove or inactivate cysts. Based on evaluation of available data and considering the data did not include device-specific testing using the USEPA protocol, the Pre-Mac model MWP water purifier receives one √ for bacteria, and viruses, and an X for *Giardia* cysts and *Cryptosporidium* oocysts (for an explanation of the rating checks click here). The following table summarizes the device's expected effectiveness against microbial pathogens, evaluation rating, and the mechanism by which pathogens are removed or inactivated:

Table. Expected Performance Against Microbial Pathogens when Used as Directed.

Microbial Pathogen Type	Expected Performance	Evaluation Rating	Inactivation/removal Mechanism
Bacteria	> 6-log	√	Iodine disinfection with some size exclusion and adsorption
Viruses	> 4-log	√	Iodine disinfection with some adsorption
Giardia cysts	Not Effective	**X**	Some size exclusion, adsorption and iodine disinfection
Cryptosporidium oocysts	Not Effective	**X**	Some size exclusion and adsorption

Production Rate and Capacity

Inherent to the production rate and capacity of filtration devices is the quality of the raw water source. The actual production rate and capacity is dependent on the user and raw water quality. The manufacturer's stated production rate is 400 ml/min. The stated capacity is 200-500 L.

Cleaning, Replacement, End of Life Indicator

When pumping becomes difficult or 200 L of water has passed through the device the cartridges must be replaced. The device is not capable of being cleaned or backwashed. Instructions recommend discarding the first 0.25L of treated water if the MWP water purifier is new.

Weight and Size

The dry weight of the device is 180 grams. Dimensions are 4.5 cm diameter x 14 cm length.

Cost

The Pre-Mac MWP water purifier is not sold at stores in the United States. The device is available through online ordering and at stores outside of the United States. The device costs approximately $100. Replacement cartridges cost approximately $45.

Device Evaluation

Based on evaluation of available data, the Pre-Mac model MWP water purifier is expected to provide 6-log bacteria and 4-log virus removal or inactivation under most water quality conditions expected. The MWP water purifier will not consistently provide a 3-log *Giardia* cyst and *Cryptosporidium* oocyst removal or inactivation. Additional treatment such as filtration with a 1 µm absolute filter will be necessary to remove these protozoan cysts. Iodine resin disinfection is the primary mechanism of bacteria and virus inactivation. The iodine resin inactivates bacteria, viruses, and some *Giardia* cysts through direct contact with the resin as well as through the iodine residual the resin imparts to the water. The device will also provide some filtration and adsorption of bacteria, viruses, *Giardia* cysts, and *Cryptosporidium* oocysts due to the activated charcoal cloth and the 2 µm pre-filter when used in high turbidity waters. There is no indicator of process failure on a real-time basis and end of device useful life is based on filter clogging, or by the user keeping track of the volume of water purified. The iodine resin releases decreasing amounts of iodine as usage continues, but there are no instructions on when to replace cartridges based on iodine residuals if measured using the optional field test kit. Inherent to treatment devices using filtration is the likelihood of clogging when processing highly turbid raw water. The optional 2 µm pre-filter should be used in highly turbid water. This will clog the pre-filter and necessitate the need for additional pre-filters but will extend the life of the purifier. The iodine resin and residual are not expected to cause any adverse health effects to healthy adults with no pre-existing thyroid conditions or sensitivity to iodine. This device is not recommended for use by pregnant women (concern for fetus), people with known hypersensitivity to iodine, people with a history (or family history) of thyroid disease, and people from areas with chronic iodine deficiency (reference 3). The iodine residual imparted by the resin can cause a medicinal taste and color the water. Iodine can be neutralized by adding ascorbic acid (Vitamin C) or sodium thiosulfate, which will improve the taste and color. Flavored drink mixes can mask the flavor. However, neutralizers and flavor aids should not be added until after directed contact times are achieved.

Advantages

- Independent testing using the USEPA protocol with a similar Pre-Mac device suggests the MWP water purifier will provide 6-log bacteria and 4-log virus removal or inactivation when treating most water quality conditions expected.
- Small and lightweight.
- Simple to use.
- No adverse health effects expected in healthy adults with no iodine sensitivity.

Disadvantages

- Not effective against *Giardia* and *Cryptosporidium*. Additional treatment is necessary.
- Not recommended for use by pregnant women or people with iodine sensitivity
- Can impart color and medicinal taste.

References

1. U.S. Environmental Protection Agency, Registration Division Office of Pesticide Program, Criteria and Standards Division Office of Drinking Water. (1987). *Guide Standard and Protocol for Testing Microbiological Water Purifiers.* Washington, D.C.

2. U.S. Army Biomedical Research & Development Laboratory. (1993). *Evaluation of the Medical Efficacy of the Pre-Mac Model FWP Individual Water Purifier for Treating Microbiological Contaminants in Water.* (USABRDL Technical Report 9204). Frederick, MD. Prepared by Shaub, S.A., Hargett, H.T., Sterling, C.R., and Marshall, M.M.

3. U.S. Army Center for Health Promotion and Preventive Medicine. (2005). *Technical Information Paper; Iodine Disinfection in the Use of Individual Water Purification Devices,* Aberdeen Proving Ground, MD.